

an account of recent research in Western Asia, and are important as giving a summary of all the latest results achieved by explorers in the valleys of the Tigris and Euphrates. The authors repeat the view recently brought forward by Mr. King that the first Babylonian dynasty was in part contemporaneous with the second, and that the latter consisted of Sumerian kings who had established themselves in the Sea Country. This contemporaneity of the first and second Babylonian dynasty, of course, brings down the chronology of Babylonian history, and this fact must henceforward be borne in mind by Egyptologists, for there are several synchronisms between Babylonian and Egyptian history which have been well established. The authors deal in the sixth chapter with early Babylonian life and customs, and this is certainly the most interesting part of the book. Since Prof. Maspero wrote his history, two new sources of information have been made available which have greatly increased our knowledge of the constitution of the early Babylonian State, and of the conditions of life of the various classes of the population. The most important new source is the great Code of Laws drawn up by Hammurâbi for the guidance of his people, and defining the duties and privileges of all classes of his subjects. This was discovered by M. de Morgan at Susa, and is one of the most remarkable documents that has ever fallen to the lot of an excavator to unearth. The other new source of information consists of a series of royal letters written by kings of the First Dynasty to the governors and officials of various great cities in Babylonia. These tablets are now preserved in the British Museum, and the range of subjects with which they deal is enormous, and, as the authors say, "there is scarcely one of them which does not add to our knowledge of the period."

The three last chapters are devoted to the most recent discoveries in connection with the history of the later periods of the Egyptian and Assyrian Empires. A good summary is to be found here of all the latest finds at Thebes, including those in the Valley of the Tombs of the Kings, which have so enriched the National Museum at Cairo.

POTENTIAL ENERGY AND THE FIGURE OF THE EARTH.

Das mechanische Potential nach Vorlesungen, von L. Boltzmann bearbeitet, und Die Theorie der Figur der Erde, zur Einführung in die höhere Geodäsie. By Dr. H. Buchholtz. Erster Teil. Pp. xvi+470. (Leipzig: J. A. Barth, 1908.) Price 15 marks.

AN intimate knowledge of the theory of potential energy is of undoubted value to the student of theoretical geodesy, and it is with this object that Dr. Buchholtz has given us in this book a complete and exhaustive treatise on the subject since its inception by Newton down to the present day. But it is not alone to those interested in the complex study of the figure of the earth that this portion of the book will appeal; for in the application of the potential theory, not only is gained a knowledge of some of the most elegant mathematical theorems, but at the same time a deep insight into nature is obtained.

It would be difficult to over-estimate the excellent treatment of the subject by Dr. Buchholtz, who in his preface acknowledges his debt of gratitude and inspiration to his former teacher, the late Prof. Boltzmann, to whom is due a great number of the explanations and theorems met with in the book.

The author takes his reader through the whole history of the subject, and the demonstrations and mathematical proofs are very clearly put. Indeed, it is the clearness and fulness of the several mathematical steps, which are so often omitted in treatises of this nature to the consequent disappointment and discouragement of the majority of students, that make the book so generally attractive.

After giving the necessary definitions and explanations of the various terms and formulæ due to all the learned philosophers who have made this subject their particular study, Dr. Buchholtz completes the first portion of the book with two very able chapters on the theory of the attraction of the ellipsoid and the potential of the La Place spheroid. In both chapters nothing has been omitted which could help the student fully to understand the complexity of this difficult question.

In the second portion of the book, which deals with higher geodesy, Dr. Buchholtz has been content to follow closely on the lines adopted by Col. Clarke in his "Geodesy." Nothing, indeed, could be more flattering to the famous English geodesist than the full use he has made of his work, from which nearly all the numerical examples dealing with the subject have been taken in their complete form.

Dr. Buchholtz, however, does not give an historical account of the various geodetic enterprises which have supplied the data for the solution of the many problems introduced, and which form by no means the least attractive portion of the English work.

The two chapters which make up this second portion of the book are confined to pure theory, but let it be said at once that the treatment is most thorough and complete, and the mathematical proofs extremely clear and easy to follow. In this respect the book is much more one for the beginner than Clarke's.

The first chapter gives a sketch of the classical theories of the form of the earth; and the various proofs by Clairant and La Place, which are of great historical interest and on which are based their respective important theorems, are fully treated. This is especially the case in the sections dealing with the well-known formula for the value of gravity at any latitude, with La Place's law of density and the deduction from it, and the observed constant of precession of the earth's ellipticity. The determination of the figure of the earth as a form of equilibrium is also fully dealt with in this chapter.

The second chapter is devoted to the calculation of distances, azimuths, and triangles on the spheroid and to "geodetic lines." It is chiefly taken from Clarke, and indeed a large portion of it is a literal translation of this work. In the matter of dealing with "geodetic lines," Dr. Buchholtz has given a far more exhaustive discussion than is to be found in most books on geodesy, the section dealing with the geometrical properties of the geodetic being excellent.

On the whole, the book should fulfil the wishes of the author—to supply a long-felt want in the German language in the shape of a short treatise on higher geodesy—though, as explained by Dr. Buchholtz in his admirable preface, many important and recent acquisitions to our knowledge of this subject have not been treated in the present volume, and remain to appear, we may hope, in a further contribution from the author.

It remains to mention that the whole book is excellently supplied with diagrams for the help of the student.

W. J. J.

ELEMENTARY SCIENCE.

- (1) *The Principles of Physics*. By A. P. Gage. Revised by A. W. Goodspeed. Pp. viii+547. (Boston and London: Ginn and Co., n.d.) Price 6s. 6d.
- (2) *Die Elektrizität als Licht und Kraftquelle*. By Dr. P. Eversheim. Pp. viii+121. (Leipzig: Quelle and Meyer, 1907.) Price 1.25 marks.
- (3) *Elementary Science for the Certificate Examinations*. Edited by W. Briggs. Introductory Section. Pp. iv+256. Price 2s. 6d. Section A, Chemistry. Pp. vii+192. By H. W. Bausor. Price 2s. Section B, Physics. By John Satterly. Pp. viii+352. Price 3s. (Cambridge: University Tutorial Press, 1908.)

(1) **T**HIS is a revised edition of a book which appeared in 1895, and the plan has been considerably altered in order to bring it into line with modern requirements. Sections have been omitted which in the opinion of the reviser are of little use to elementary students. These omissions consist chiefly of experiments to be performed by the student and the more remote applications of principles. New sections have been added describing in an elementary way the results of recent researches and practical applications. The plan adopted throughout the book has been to avoid so far as possible proofs of mathematical formulæ, and to explain the principles by experimental and descriptive methods. The first 150 pages are devoted to the subject of experimental mechanics. Sound, heat, light, including the elementary parts of interference, diffraction and polarisation, and electricity and magnetism form the rest of the volume. The statement on p. 229 is evidently an error, viz. :—

“Since liquids must be contained in a vessel of some sort the *observed* expansion is usually not that of the liquid alone, but a value *greater* than the real expansion of the liquid by the increase of volume of the vessel.”

Again, on the same page india-rubber is cited as having a negative coefficient of expansion. An example of this kind should certainly be avoided with elementary students, the apparent contraction when heated being due to change in the elastic constant. The statement in italics on p. 278 is likely to confuse an elementary student, viz. “The illuminating power of light diminishes as the square of the distance from the light source increases.” “Intensity of illumination” is better, “illuminating power” being regarded as a constant for the source of light.

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The book is very well printed, and the illustrations are clear. It may be safely recommended to students who take up physics as part of their general education.

(2) “Elektrizität,” by P. Eversheim, is a small book describing some of the present-day applications of electricity. It is intended for the general reader, or for those who have only a very slight acquaintance with the elementary facts of electricity.

The author first describes the various methods by which a current of electricity may be produced, and then proceeds to explain the phenomena of electromagnetic induction and the principles of the dynamo and motor. Practical applications are then dealt with, the subjects treated including electric lighting and various types of lamps, transmission of power, the electric telegraph, cable telegraphy, the telephone, electric waves, and wireless telegraphy.

As a rule, the explanations of phenomena are clear and accurate, and should be intelligible to the general reader, but the diagram on p. 9 will not give him a correct idea of the magnitude of thermoelectric currents, viz. a single couple with junctions at 0° and 50° joined to an ammeter reading one ampere. Again, in a book of this size one cannot expect full historical treatment, but the omission of the name of Faraday from the chapter on electromagnetic induction cannot be passed over without comment, especially when that of Lenz is included.

In Fig. 56, p. 113, “Braun” system of wireless telegraphy, the “earth connection” is in the wrong place. The “Aërial” should be earthed. In Fig. 58 the “earth connection” or “balancing capacity” are omitted. At the end of the book is a short section referring the reader to larger treatises on the subject of electricity and its applications.

(3) These three manuals comprise a course in elementary science suitable for the certificate and preliminary certificate examinations for 1909. The introductory section deals with the elementary measurement of length, area, volume, mass, density, &c.; properties of matter; thermometry and expansion; nature and composition of air and water; action of acids on metals, and of heat on some organic substances. The fundamental facts are well illustrated throughout by simple experiments to be performed by the student.

Section A is a further continued course in chemistry. The properties and interactions of some common substances are dealt with experimentally, and the fundamental laws of chemistry explained. The author has avoided formulæ and equations of reactions so far as possible in the text, introducing them in an appendix at the end.

Section B is a continuation of the physics course; mechanics, heat, light, electricity and magnetism are dealt with, the facts being well illustrated by simple laboratory experiments. The explanation of multiple reflections from thick mirrors avoids a very common error usual to text-books, but it is not true to say that all the images are on the normal to the mirror through the object. Fig. 33, p. 337, is misleading if intended to illustrate the probable result of the experiment numbered 37.